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RES Investigation of the Aurora Basin Area (East Antarctica)

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BEDROCK FEATURES, ICE THICKNESS AND SUBGLACIAL LAKES

We analyse radio echo sounding (RES) data on the region between Lake Vostok and the Belgica Subglacial Highlands (East Antarctica) collected during four Italian expeditions (1995, 1999, 2001 and 2003). The survey aimed to define the morphological characteristics of the Aurora Trench and to aid the exploration of subglacial lakes.

Analysed RES data were acquired with an airborne radio echo sounding system (named INGV-IT) designed for remote-sensing studies of polar ice in Antarctica. Radar instrumentation has been continuously enhanced and improved since 1995 (Tabacco et al. 1999). The location of radar traces was determined using a GPS system coupled with the radar. Surface elevations are based on the ERS-1 dataset (Remy et al. 1999). On account of differences in the adopted radar systems, the entire data set was processed in order to prepare a homogeneous and comparable data base.

Ice thickness was computed assuming a constant electromagnetic wave velocity in the ice of 168 m/ms (Glen & Paren 1975). The bedrock topography was obtained by subtracting the ice thickness from the ERS-1 surface elevation. The elevation of the bedrock was referred to the WGS84 ellipsoid and is reported in figure 1. The main feature within the Aurora Subglacial basin is the Aurora Trench, a large depression extending in an approximately N-S direction between longitudes 115°E – 118° E. It is about 300 km long and 15/50 km wide. Elevation increases from north to south, ranging from -1000 to -1550 m, with a slope of about 3.6 m/km. The eastern and western flanks have a gradient of more than 50 m/km. This morphology suggests a tectonic origin. The deepest portion of the trench, located at 118 328° E and 76 054°S, has a bedrock elevation of -1549 m and an ice thickness of 4755 m (accuracy ± 16 m, Forieri et. al 2003). This thickness, controlled by three different legs, is to date one of the largest ones ever measured in Antarctica.

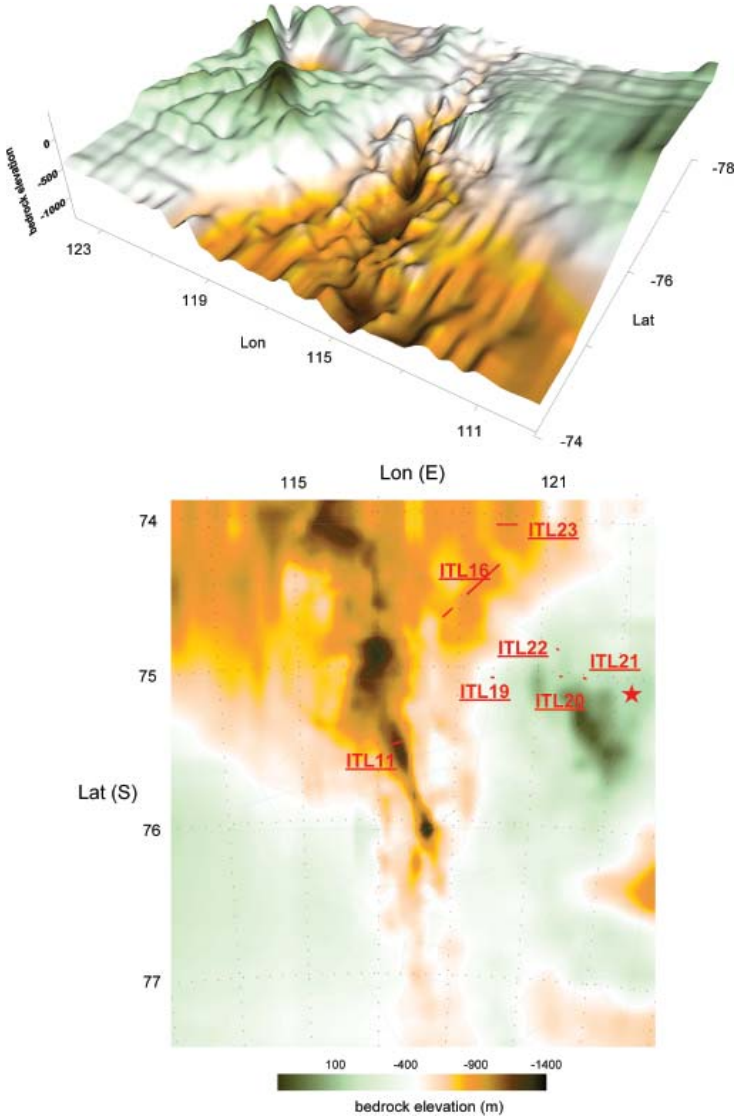

Fig. 1 - Bedrock elevation: (a) 3D view; (b) 2D view. Concordia Station is indicated as a red star and radar tracks over the new subglacial lake are reported as red segments.

Five new subglacial lakes were also detected during data analysis. Four very small ones (ITL19, ITL20, ITL21 and ITL22) are located in the Belgica Subglacial Highlands, and one (ITL23) is located in the Aurora Basin. Three other radar tracks confirm the existence of catalogued lakes ITL11 and ITL16 (Lake Aurora). Radar tracks are reported in figure 1 as red segments. The radargrams of the cited subglacial radar tracks are shown in figure 2. These new data bring the total number of lakes identified in this region to 40.

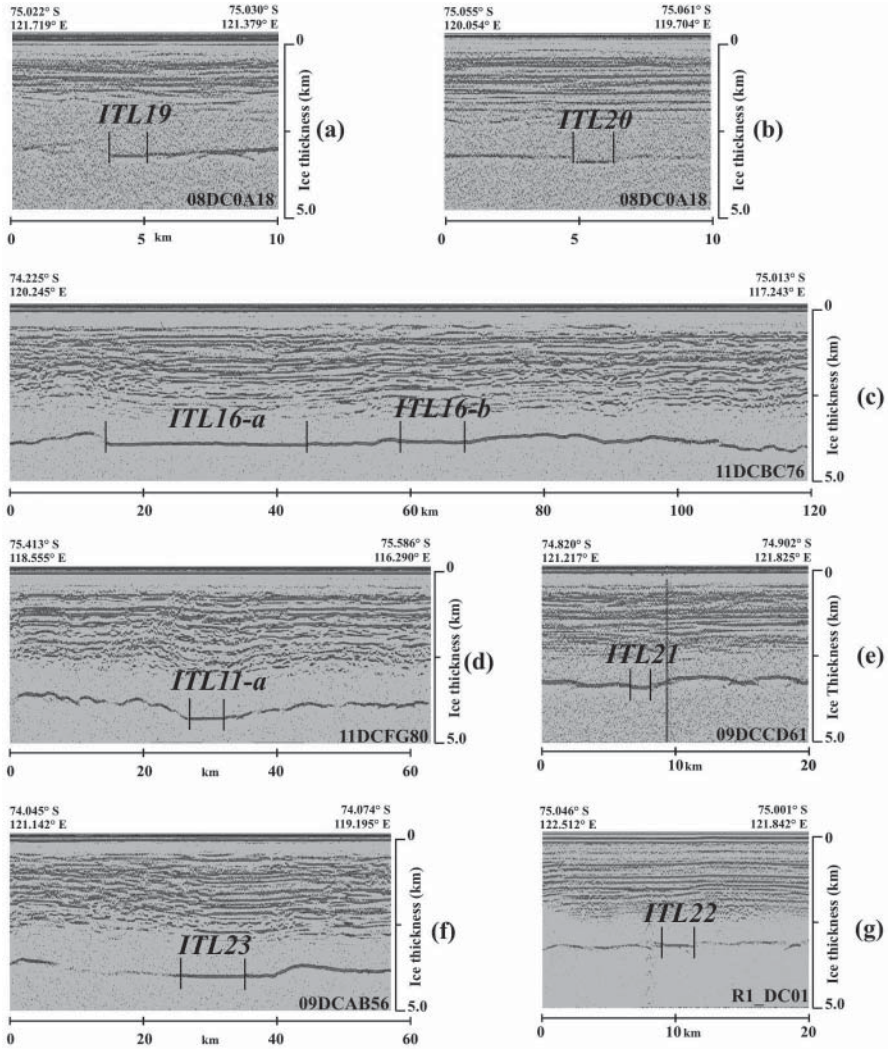

Fig. 2 - Radargrams of the new subglacial lakes.

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